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ABSTRACT

"Time is Brain"

Stroke is the leading cause of disability and the third leading cause of death in the United States. Urgent stroke management is constrained by a narrow, 3 hour therapeutic window for treatment with intravenous recombinant tissue plasminogen activator (IV rt-PA), the "brain saving" drug. Using IV rt-PA requires rapid diagnosis and an organized approach to acute stroke care.

Emergency room (ER) healthcare providers inexperienced with using IV rt-PA have been reluctant to initiate this treatment, due to known brain bleeding side effects. Misdiagnosing a non-cerebrovascular condition as a stroke is a subsequent concern. Past studies indicated that many ER physicians do not accurately interpret brain computed tomography studies (CTs). Sufficient interpretation of brain CTs is crucial to ruling out brain hemorrhage and cerebral infarctions not amenable to thrombolytic therapy.

Telemedicine technology can provide immediate, remote stroke assessment and treatment by experts. Rural areas in the United States and the US military medical system would benefit from remote expert telemedicine consultants. The ability to better triage patients will not only improve stroke care but will also reduce cost by this drug benefit. The cost of treating stroke in the United States was $40.9 billion in 1997.

A preliminary study demonstrated the use of remote telemedicine examinations to accurately and quickly perform a patient stroke scale assessment necessary for stroke evaluation. Walter Reed Army Medical Center (WRAMC) has a 24-hour on-call stroke team consisting of an interventional radiologist, a neurologist, neurovascular neurosurgeons and an accredited vascular laboratory. Similar resources have proven to decrease mortality rates in a variety of medical conditions at large teaching hospitals. The ability to initialize critical stroke management at remote regions with immediate transfer to the tertiary center would utilize these resources and at the same time improve patient outcomes and quality of life. The proposed study seeks to establish the feasibility of telemedicine consultation in the diagnosis of stroke. Telemedicine evaluation of the neurological examination and brain CTs will be investigated.

BODY

Overview

Design:
Prospective clinical trial
Locations:
Phase I: Walter Reed Army Medical Center (WRAMC)
Phase II: WRAMC, (Dr.'s office and ER);
Ft. Bragg, (Dr.'s office); NNMC (Dr.'s office).
Funding:
$ 218,730
Associate Investigators:
LTC Geoffrey Ling MC, LTC Robert Labutta MC Department of Neurology, WRAMC
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Project Officer:
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Trials Coordinator:
Gabriele Feolo, RN, MSN; Department of Neurology

Project Description

Background:Acute stroke care has a limited therapeutic window, IV rt-PA =< 3 hours.

- Telemedicine technology can provide a valid diagnostic tool for urgent stroke care.
- Provide stroke expert consultation that may be more effective than telephone advice.

Hypothesis:VTC is a valid clinical tool for urgent stroke care, with no difference in diagnostic accuracy and time efficient patient assessment from "in-person" evaluations.

Objectives

Plan:Test feasibility of telemedicine consultation in the diagnosis of stroke.

- Compare conventional "in-person" vs. "telemedicine" physician evaluations.
- Validate a telemedicine procedure within the critical time frame.
- Explore patients' and physicians' satisfaction with examination using VTC.
- Improve patients outcomes and reduce healthcare expenses.

Methodology

Subjects:Simulated patient encounters:

- Normal neurological examination (control subjects).
- Abnormal neurological examination (non-stroke subjects).
- Abnormal neurological examination (stroke subjects).
- Each subject receives two consecutive, neurological evaluations.

Compare:"In-person" vs. "telemedicine" interventions:

- Evaluate accuracy of diagnosis.
- Measure time used for:
  - Patient interview
  - NIHSS examination
  - CT-Scan interpretation

KEY RESEARCH ACCOMPLISHMENTS

Infrastructure

The phase I/pilot study phase was conducted. Six telemedicine consultations were completed. Virtual patient consultations were televised from the WRAMC's ER (location of the study participant) to the remote neurology consultant (Dr.'s office at WRAMC.)

Deliverables

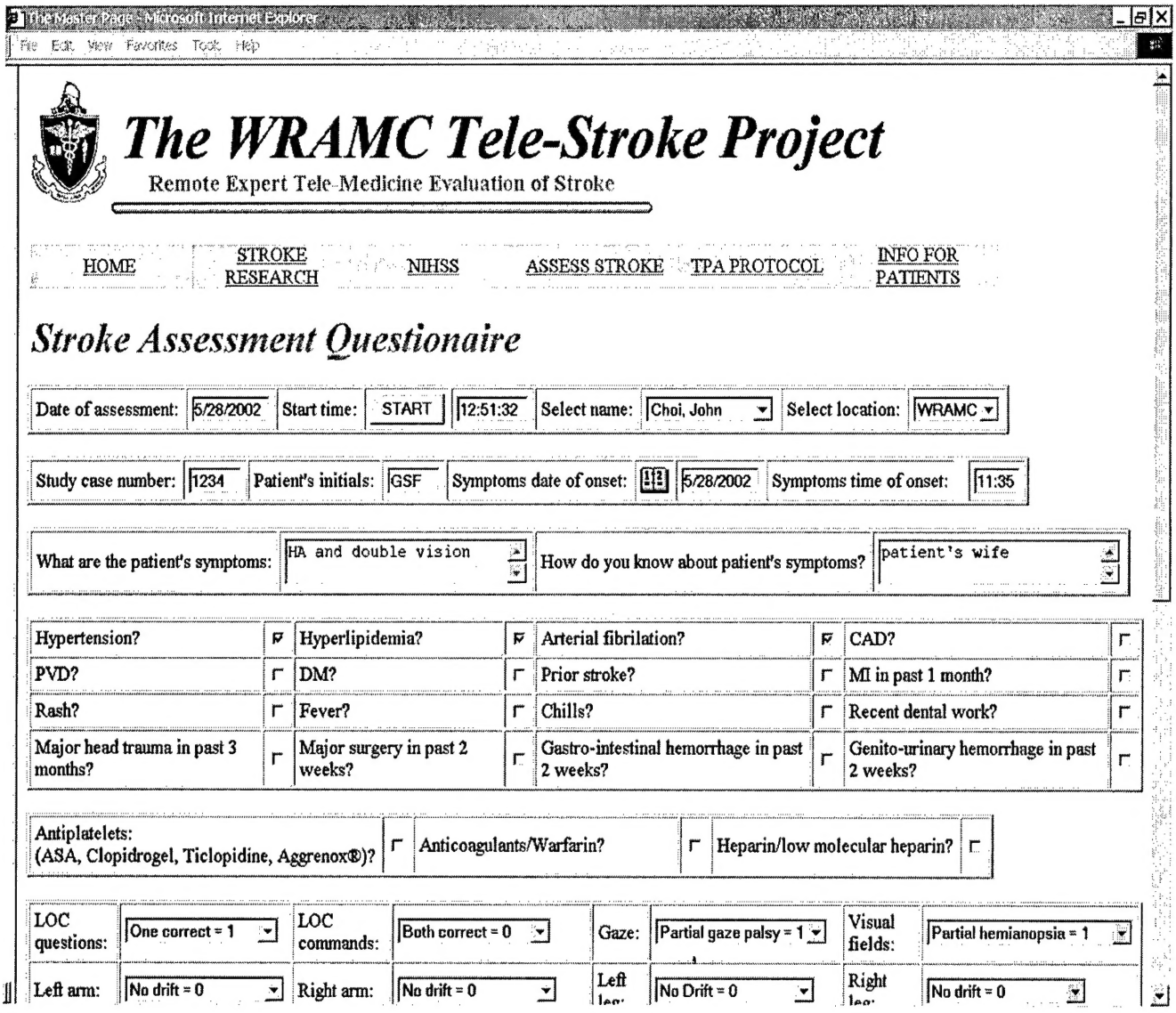
Decision Support Tools:Developed an MS-ACCESS application executed "on-screen" during the VTC session, (front-end & database).

- Included an IV rt-PA calculator.
- Application ensures uniformity of evaluations.

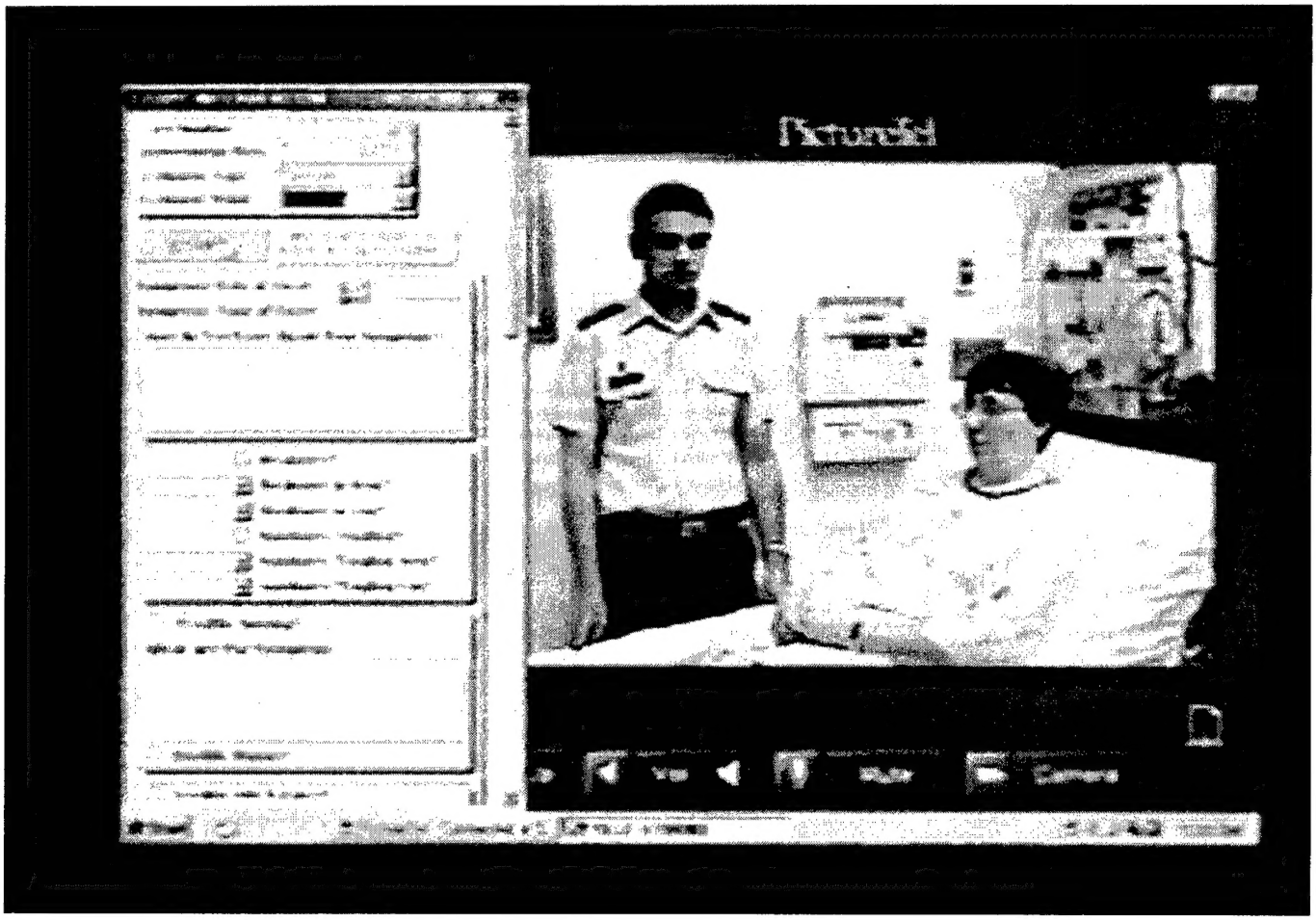
Modify Phase II study design based on Phase I observations:For data collection and to continue uniformity of evaluations:

- Developed a Website for the remote ER consultant.
- Developed a PDA application for the in-person consultant.

Web Based Case-Report-Form (Example)

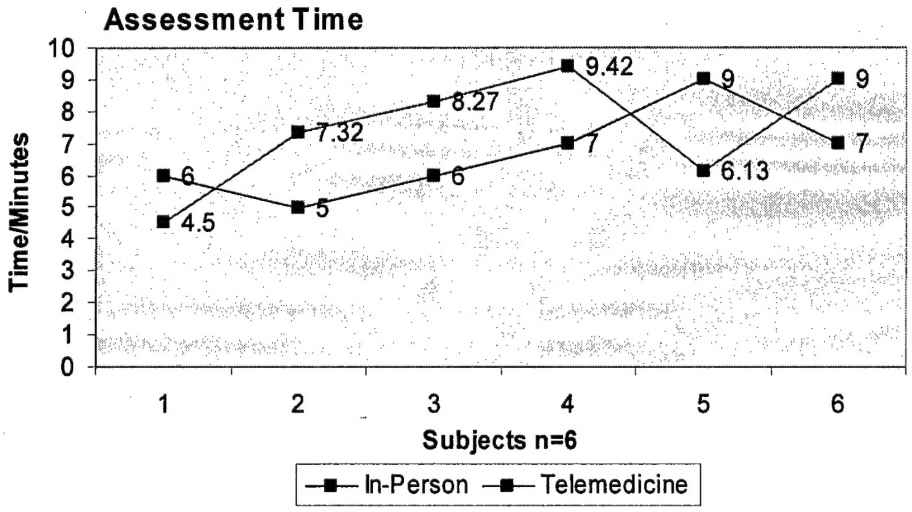


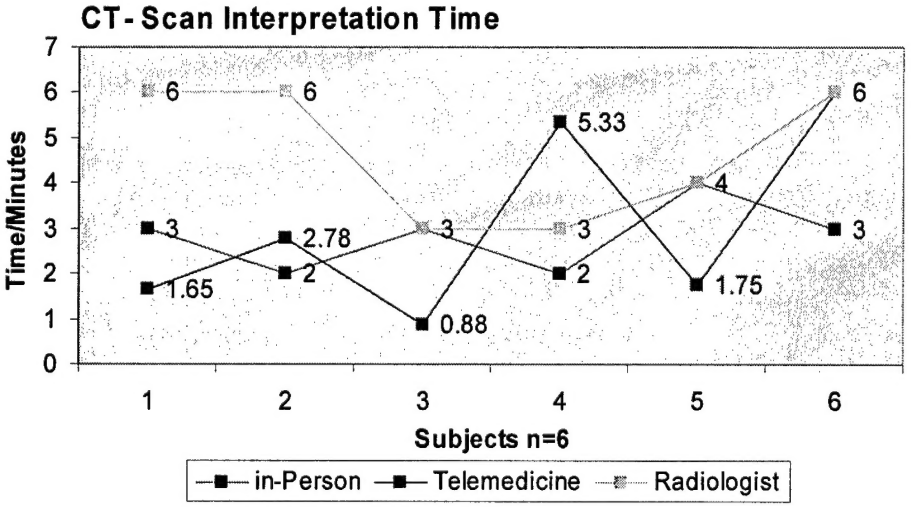
VTC Study Intervention / Snap-Shot of a Televised Remote Consultation

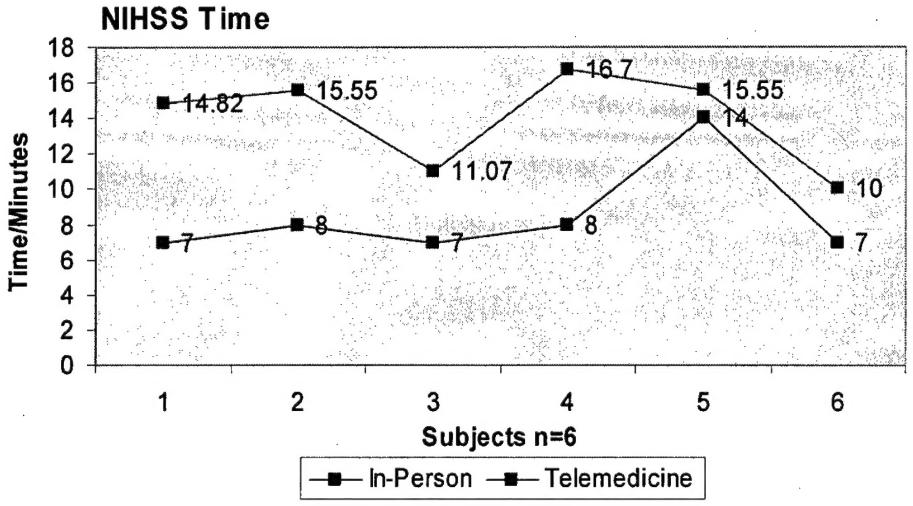


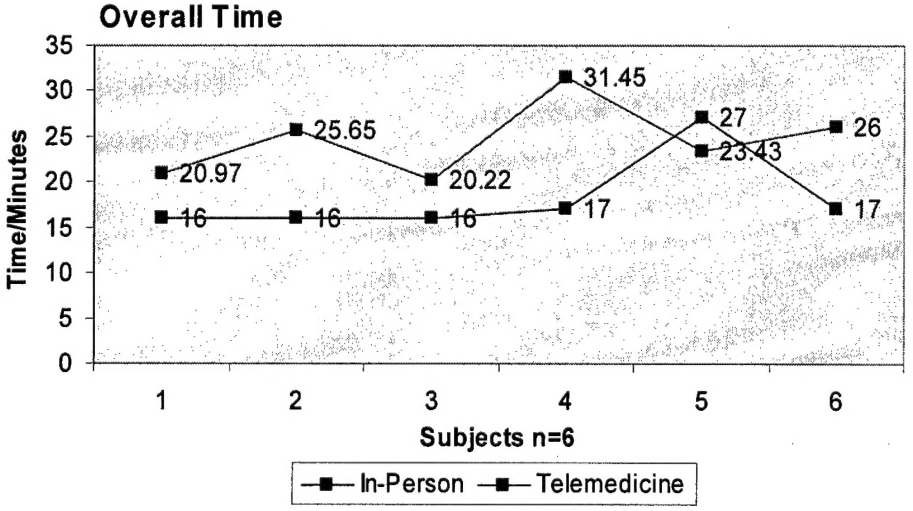
REPORTABLE OUTCOMES

Results: "Times Measured






NIHSS Time
Time/Minutes
18
16
14
12
10
8
6
4
2
0
14.82
15.55
11.07
16.7
15.55
10
7
8
7
8
14
7
1
2
3
4
5
6
Subjects n=6
In-Person
Telemedicine


Overall Time
Time/Minutes
35
30
25
20
15
10
5
0
20.97
25.65
20.22
31.45
23.43
26
16
16
16
17
27
17
1
2
3
4
5
6
Subjects n=6
In-Person
Telemedicine

Results: "Study Diagnosis"

Date	Case#	Evaluator Type	NIHSS	DX	DX, If Non Stroke
11/30/2001	1	In Person	0	Non-Stroke	R hand parathesias R/O mononeuropathy
11/30/2001	1	Telemetry	0	Non-Stroke	appears to be likely carpal tunnel syndrome.
12/4/2001	2	In Person	0	Non-Stroke	migraine headache, not likely subarachnoid hemorrh
12/4/2001	2	Telemetry	0	Non-Stroke	Benign headache
12/6/2001	3	In Person	0	Non-Stroke	r/o myastenia gravis r/o GBS
12/6/2001	3	Telemetry	0	Non-Stroke	r/o GBS
12/18/2001	4	In Person	1	Stroke	
12/18/2001	4	Telemetry	0	Stroke	This is most consistant with a TIA, NIHSS <4.
1/9/2002	5	Telemetry	1	Stroke	
1/17/2002	5	In Person	0	Non-Stroke	Muscle contraction headdache
3/1/2002	6	In Person	3	Stroke	Could also be psychogenic, did coordinate very well, unlikely complicated migraine HA

Statistical Analysis

Time in Minutes	Mean	Median	SD	SE	Range	*P* value
Total Time: In-Person	18.17	16.5	4.36	1.78	(16-21)	0.063
Total Time: Telemedicine	24.62	24.54	4.09	1.67	(20.22-31.45)	(In-Person vs. Telemedicine)
History Time: In-Person	6.67	6.5	1.37	0.56	(5-9)	0.563
History Time: Telemedicine	7.44	7	1.87	0.76	(4.5-9.42)	(In-Person vs. Telemedicine)
NIHSS Time: In-Person	8.5	7.5	2.74	1.12	(7-14)	0.031
NIHSS Time: Telemedicine	13.95	15.19	2.73	1.12	(10-16.7)	(In-Person vs. Telemedicine)
Brain CT-Time: In-Person	2.83	3	0.75	0.31	(2-4)	0.125*
Brain CT-Time: Telemedicine	3.07	2.27	2.11	0.86	(0.88-6.0)	0.313*
Brain CT-Time: Neuroradiologist	4.67	5	1.5	0.61	(3-6)	(*Neuroradiologist vs. In-Person/Telemedicine)

CONCLUSIONS

Conclusion

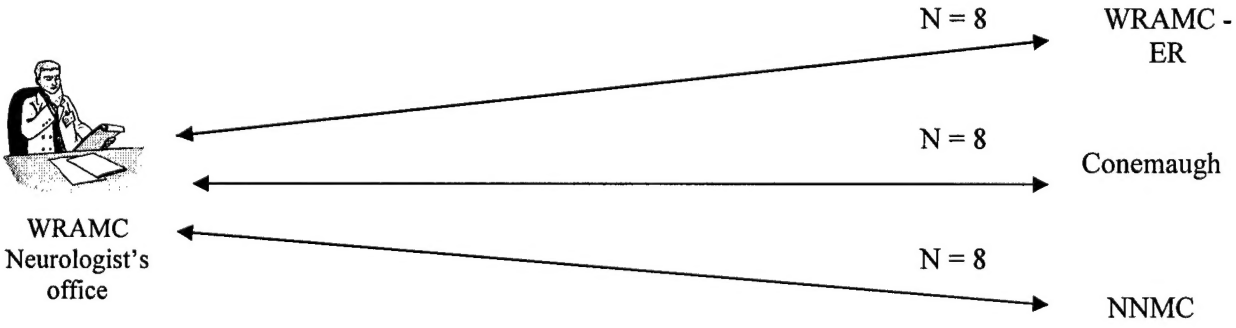
- Provide immediate, consistent and efficient stroke consultation (VTC & computerized standardized assessment tool).
- Reduce potential risk of medication errors, (IV rt-PA calculator).
- Tool to learn neurological stroke assessment skills, (residents).
- Protocol is easily transferable to an AMEDD wide urgent stroke care regimen.
- Save healthcare dollars while increasing access and quality of care.
- Benefit for US military medical system and remote areas with expert "telemedicine stroke consultations".

Next Step

Where Should This Technology Go From Here?

- Plans with sustained funds to continue Phase II with probable remote site for Ft. Bragg, NC and National Naval Medical Center, MD.
- Testing of the Tele-Stroke study protocol in a rural area healthcare setting in the United States (and/or outside the US military medical system).

Infrastructure / Phase II



Total N for all sites = 40 (40 in-person & 40 Tele-consultations.)
N for each remote site = 8 (8 in-person & 8 Tele-consultations.)
N for WRAMC = 24 (24 in-person & 24 Tele-consultations.)

APPENDIX A: PRESENTATIONS, POSTERS, PUBLICATIONS

Choi J, Hoffstetter E, Feolo G, Lucci E, Labutta R, Depper M, Kudelko K, Poropatich R, "A Study for the Use of Telemedicine/Teleradiology in Acute Stroke," presentation at the American Telemedicine Meeting, 2002, Los Angeles, CA.